REMARKS

Claims 1-9, 11 and 13-15 are pending. By this response, the claim 11 is amended and claim 10 canceled. Reconsideration and allowance based on the above amendments and following remarks are respectfully requested.

§112, First Paragraph

The Examiner rejects claim 10 under 35 U.S.C. §112, first paragraph for failing to comply with the written description requirement. This rejection is respectfully traversed.

First, the Examiner states in the Office Action that claim 10 was not argued or amended to comply with the written description requirement and thus she maintains her rejection. Applicants have not found a rejection of claim 10 in the previous Office Action dated September 20, 2006 regarding claim 10 failing to comply with the written description requirement. In fact, there wasn't a rejection under 35 U.S.C. § 112, first paragraph in that Office Action.

In any event claim 10 has been canceled. Thus, the rejection is now moot. Accordingly, withdrawal of the rejection is respectfully requested.

Prior Art Rejection

The Office Action rejects claim 1-9 and 11-15 under 35 U.S.C. § 102(b) as being anticipated by Hori et al. (EP 1 154 379 A2) and claims 10 and 15 under 35 U.S.C. § 103(a) as being unpatentable over Hori in view of Cieplinski et al. (WO 00/67203). These rejections are respectfully traversed.

Applicants remarks regarding the Hori reference filed in the Response dated December 20, 2006 are hereby incorporated by reference.

Discussion of the Invention

Embodiments of the present invention are concerned with an improved method for representing moving objects appearing in a sequence of images. Various existing techniques for deriving representations of an object in a sequence of images are discussed in the introduction to

the application. For example, "Figure Trajectory" involves tracking representative points of an object through a sequence of frames, and deriving a function approximating the trajectory of each coordinate for each representative point, using techniques such as linear approximation, quadratic approximation or spline function approximation. However, such existing techniques are generally not very accurate.

Embodiments of the present invention provide an improved technique, whereby an approximate function is derived representing the trajectory of one or more representative points of an object in two or more of a sequence of images. An error value for said approximate function is then calculated for the (or each) representative point of the object. Importantly, the error value is based on the difference in the area of the object, as represented by the representative point in the images, and the area of the object, with the representative point replaced by the respective approximate function value.

This difference in area is illustrated in Figure 8 of the application. As described in the present application, the solid line in Figure 8 shows the object outline (defined by reference points) including a reference point A. A derived approximate function, representing the trajectory of the representative point A in a sequence of two or more images of the object, places the reference point A with a different y value at reference point A'. (Note: reference point A' could equally also have a different x value). Thus, the error value is based on the change (or difference) in area of the object with its vertex at reference point A (original polygon) and the area of the object with the vertex at reference point A' (modified polygon).

The calculation of an error value based on a change in area is not straightforward, since, for a sequence of images, movement of more than one reference point/vertex is likely to occur. The calculation of the change in area by using approximate values for the other reference points/vertices are implemented based on their previous position (or alternatively extrapolated values) - as illustrated in Figure 8. A practical advanced algorithm for this calculation is given by equation 2 at page 14, lines 15 to 17.

Discussion of Prior art (Hori et al)

Hori et al discloses a technique for describing (Le. representing) an object in an image, so that it can be searched more efficiently and effectively. The technique involves approximating the object and extracting a plurality of (reference) points representing the object of each frame and then approximating trajectories for the points with approximate functions, which are then used to describe the object region data (see claim 1). In particular, the approximate function is derived as described from paragraphs [0056] to [0058] and in more detail in columns 14 and 15.

Specifically, in one embodiment, an approximate function is derived that expresses the values of the X-component and the Y-component of each vector/reference point (paragraph [0067]), and for a given vector, an approximate function for the trajectory of the X-component is derived, for example, using least-squares over a given time range (paragraph [0072]). Note that a second approximate function is derived for the trajectory of the Y component (paragraph [0079]).

In contrast to the embodiments of the present invention, the determination of the error in the approximate function of Hori is different from the presently claimed invention.

The approximate function (for the X- or Y- trajectory) in Hori *et al* is tested using an error value and if the error value is too large, then a new approximate function is derived (paragraph [0076]). The error value is calculated using the equation at column 15, lines 20 to 25. This equation defines the maximum difference between the actual X-component value for a given vertex and the corresponding value according to the approximate function, over the given time range. This represents a change or difference in <u>position,</u> i.e. a one <u>dimensional linear value (X or Y).</u>

In contrast, the error value in accordance with the present invention is based on a change or difference in the two-dimensional area of the object, using both the X and Y values of the actual reference point A and the reference point according to the approximate function A'.

Thus, Hori fails to teach, *inter alia*, calculating an error value for said approximate function for the representative point for an image, wherein the error value is based on the change

in area of the object as represented by the representative point and the area of the object with the representative point replaced by the respective approximate function value, as recited in claims 1, 11, 13 and 14.

Response to the Examiner's Comments

Paragraph 5

In paragraph 5, the Examiner responds to Applicants' previous remarks in support of novelty of the present invention over Hori et al. The Examiner suggests that "reference teaches a method of setting the area of the approximate figure to the value obtained by multiplying the area of the object region by a constant. Moreover, to make the determination to change the reference object region to an object region depends on the error between the actual object region and the predicted object region, a ratio of the area of a common portion of both regions to the area of a part which is not common can be used [0335]."

First, Applicants note that the Examiners comments are somewhat confusing. The Examiner's comments are not clear in view of the teachings of Hori and thus difficult to follow.

Second, Applicants do find anywhere in Hori et al where Hori mentions "setting the area ..., a value obtained by multiplying the area of the object region by a constant", although it seems that the term "reference object region" relates to a two dimensional shape.

Also, Paragraph [0335] of Hori et al relates to the determination of when a reference region needs to be changed to that of another frame rather than the determination of a representation of the motion of an object in a sequence of images. The method at paragraph [0335]: "determines whether or not the error between the actual object region in a certain frame and a predicted object region exceeds a preset threshold" and the error is "a ratio of the area of a common portion of both regions to the area of a part which is not common."

Thus, the error described in paragraph [0335] does not relate to a difference (or change) of an area of the object as represented by the (actual) representative point and the representative point replaced by the respective approximate function value (i.e. a two dimensional quantity).

Rather the error is a dimensionless ratio of overlapping and non-overlapping areas of the actual object region and a predicted object region.

Hori et al does not specify a practical algorithm for the calculation of the ratio, and it is not evident how such a ratio could be calculated given that it requires the determination of an area of both common and non-common portions of the object in the reference frame and a subsequent frame approximated by the "temporal function." Even so, a dimensionless ratio of the areas of common and non-common portions represents something quite different from a two dimensional difference or change in area.

For example, suppose this calculation of the ratio were performed in relation to the object in Figure 8 of the present application, as illustrated in the attached drawings (Figures X, Y & Z attached hereto for exemplary purposes only, not part of the application drawings). Figure X shows the object, having area 0 in a reference frame and Figure Y shows the object in a subsequent frame approximated by the temporal function having area 0'. By overlapping these images, as shown in Figure Z, it can be seen the entire area of the object 0' in the subsequent frame is common with the area of the object 0 in the reference frame. The area of the common portion is therefore area 0' and the area that is non common (the shaded area S) is 0 - 0'. The <u>ratio</u>, according to the teaching of paragraph [0335] of Hori *et a! is* calculated as: 0' / (0 - 0'). In contrast the <u>difference</u> between the areas would be (0 - 0'). Note that this is a simplified example, where the area in common is the entire area *of* the object in the subsequent frame, which is rarely the case (but may arise if, for example, the camera is "panning out"). Usually a more complex calculation is needed for determining the area S, representing the non-common portion, and the ratio then has no relation to the difference in area of the two objects.

It is further noted that in one embodiment of the present invention, the difference in area is determined, in accordance with equation 2, using the area of the object with vertex A and the area of the object with vertex A' (i.e. with the position of the other vertices B, C, D, E & F unchanged). This is different from the technique in Hori et al where, according to paragraph [0335], the temporal function/conversion parameter is applied to all vertices to give the reference object region, before determining the common and non-common areas. However, as mentioned

above. Hori et al provides no disclosure, in terms of an algorithm, of how the ratio it proposes is actually calculated.

Accordingly, it is submitted that the invention as defined in amended claim 1 is distinguished over the teaching of Hori et al for these reasons.

Paragraph 9

In paragraph 9, in relation to claim 1 the Examiner suggests that Hori et al discloses an error value "based on a change in area of the object as represented by the representative point and the area of the object with the representative point replaced by the respective approximate function value" at column 15, line 21. However, the approximation error is calculated only for the X-component of the vertex (see paragraphs [0069] and [0070]), and thus it cannot possibly derive an error based on a difference in a two dimensional area. Rather, as stated above, the equation derives a one dimensional error, namely the maximum difference between the actual X-component value for a given vertex and the corresponding value according to the approximate function, over the given time range.

In relation to obviousness, it is observed that the embodiment in Hori et al which utilizes the equation at column 15, line 21, necessarily separates the X- and Y- components of each vertex (reference point) and calculates an error value on a change of difference in position. This illustrates that it was not obvious, at the time of the present invention, as to how an error value could be calculated based on a difference in area, given the fact that the different vertices have key points at different times.

By contrast, the present claimed invention discloses techniques in the form of practical algorithms whereby this can be achieved, which techniques are neither known from the prior art not obvious in view of it.

The embodiment in Hori et al described at paragraph [0335}, which utilizes an error value based on a ratio, equally has little relevance to the present invention, as it does not relate to a method of representing motion of an object appearing in a sequence of images, and also for the reasons set forth above.

Withdrawal of the Rejections is Requested

For the reasons set forth above, Claims 1, 11, 13 and 14 are distinguishable from the cited references. Further, claims 2-9, 11 and 13-15 are patentable on the basis that they are dependent upon, or incorporate, the method of claim 1, which is novel and non-obvious, for the reasons set out above.

Accordingly, reconsideration and withdrawal of the rejections are respectfully requested.

Conclusion

For the reasons above, it is respectfully submitted that claims 1-9, 11 and 12-15 are distinguishable over the cited art. Favorable consideration and prompt allowance are earnestly solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Chad J. Billings Reg. No. 48,917 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

By ~~D. Richard Anderson~~ 48,917

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Attachments